RESPONSES TO AGENCY COMMENTS ON TECHNICAL MEMORANDUM NO. 3: CONTAMINANT MIGRATION ANALYSIS TO SUPPORT THE DEVELOPMENT OF CLEANUP GOALS FOR THE NAVY EXCHANGE GAS STATION (SITE 3) NAVAL TRAINING CENTER, SAN DIEGO, CALIFORNIA

Originator: *Laurie Apecechea, DEH SAM*
Date: *7 May 1996*

Comment 1. In the groundwater migration analysis portion of the memorandum, the analysis factored in transport due to advection, dispersion, and biodegradation. Typically the transport analysis should be run with and then without a biodegradation factor so the worst case scenario can be determined. Additionally, in the absence of supporting documentation for biodegradation at the site this will facilitate the review process.

Response 1. Comment acknowledged. As stated in Section 2.1.2.1, a literature search was conducted regarding biodegradation rates for BTEX. Reported biodegradation rates (half-life) ranged from 0.29 to 9.5 years for benzene, 0.04 to 1.81 years for toluene, 0.06 to 2.4 years for ethylbenzene, and 0.09 to 2.34 years for xylenes. Conservative half life values of 5 years for benzene and 2 years for toluene, ethylbenzene and xylenes were used in the analysis.

Analysis using lower biodegradation rates, including the case of no biodegradation, were added to the sensitivity analysis (Section 2.4). The results of the sensitivity analysis indicate that for benzene biodegradation rates greater than 8 years half-life, the predicted peak benzene concentration at the discharge point would exceed the water quality goal. However, there is no reason to believe that biodegradation is not occurring, at least at a conservative rate, at this site. Also, this result is based on a number of other conservative assumptions such as plume area and depth, plume concentration, dispersivity values, tidal mixing factors, etc. The analysis also neglects retardation, volatilization, and dilution.

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Comment 2. The validity of the parameters in Table 2-1 is the second area of concern. The table lists a Storage Coefficient of 0.03. This value is referenced to Bechtel National Inc. Extended Site Assessment Report, May 1995 page 3-12. However, page 3-12 is a table representing water levels observed on site.

There is a discussion of the aquifer testing that was conducted on pages 3-21 through 3-55 but it is not clear if this is the portion that should have been referenced. If this portion is the basis for the interpretation there is a statement that due to tidal influence the data was difficult to interpret.

The site assessment report presents Figure 3-13 as corrected data from the recovery phase of the pumping test. Is this the graph that was used to calculate the transmissivity/hydraulic conductivity and the storage coefficient? If this was not the graph used to determine these values, please provide information on how these values were calculated.

Response 2. Comment acknowledged. The storage coefficient value of 0.03 was calculated using the graph on Figure 3-13. However, the contamination migration analysis has been revised based on storage coefficient values ranging from 0.1 to 0.001.

Hydraulic conductivity values calculated from the aquifer testing conducted at Site 3 were 0.43 ft/day and 0.35 ft/day. The range of published hydraulic conductivity values for silty to clayey sand is 2.8×10^{-3} ft/day to 28 ft/day (Freeze and Cherry 1979). A conservative hydraulic conductivity value of 10 ft/day was used for the migration analysis to maximize migration velocity.

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Comment 3. On page 2-8, Representation of the Identified Plumes during the Site Investigation, the assumed BTEX values for the dissolved plume are listed as: B = 30 mg/L; T = 38 mg/L; E = 4.1 mg/L; X = 16 mg/L However, where water is in direct contact with free product the effective solubility values on page 2-9 are: B = 64.8 mg/L; T = 27.1 mg/L; E = 3 mg/L; X = 10.1 mg/L Why are assumed toluene, ethylbenzene, and xylene values higher than the estimated solubility in the dissolved plume?	**Response 3.** Comment acknowledged. The first set of concentration values correspond to the highest concentration of BTEX detected at the site. The second set of numbers correspond to effective solubilities for textbook gasoline composition. The detected concentrations of toluene, ethylbenzene, and xylenes are greater than the listed effective solubility values. The product released at the site may have a higher content of toluene, ethylbenzene, and xylenes than the textbook gasoline composition. The contaminant migration analysis was conducted using the listed effective solubility or detected concentration, whichever was higher, for assumed groundwater concentration (i.e. B = 64.8 mg/L; T = 38 mg/L; E = 4 mg/L; and X = 16 mg/.L). Sections 2.1.2.2 and Table 2-4 have been modified accordingly.
Comment 4. Section 2.1.2.3 described tidal mixing in sediment near the discharge to the Bay. How sensitive is this equation to variability in storage coefficient?	**Response 4.** Tidal mixing factors have been calculated for storage coefficient values ranging from 0.1 to 0.001. The resulting tidal mixing factors ranged from 6.5 to 55. As a conservative assumption, a tidal mixing factor of 5 was assumed for the simulation. Section 2.1.2.4 and Appendix B have been modified to incorporate these results.

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Comment 5. On page 2-18, the effective solubility of BTEX components are listed as: B = 326 mg/L; T = 98 mg/L; E = 12 mg/L; X = 36 mg/L These values are significantly different from those presented on page 2-9. Which values are correct?	**Response 5.** These are the effective solubility values for a hydrocarbon mixture with a mass composition of 15% benzene, 18% toluene, 8% ethylbenzene, 26% xylenes, and 33% other hydrocarbons with average molecular weight of 100. This is the average composition of 8 groundwater samples collected from the site. The high mass and mole fractions of BTEX measured in the hydrocarbon mixture found at the site are most likely due to the high mobility of BTEX. To simplify the discussion, references to this set of effective solubility values, based on average composition of groundwater samples from the site have been removed from Technical Memorandum No. 3. Section 2.3.3, and Tables 2-6 and 2-7 have been modified accordingly.
Comment 6. At this time the Site Assessment and Mitigation Division cannot agree that the extent of contamination has been delineated. There still remains issues regarding impacts off-site to the southwest. Additionally, the potential impacts of vapor migration on-site and off-site have not been sufficiently addressed.	**Response 6.** It is not the purpose of Technical Memorandum No. 3 to delineate plumes or to evaluate sources but rather to analyze contamination migration based on a conservative representation of the conditions at the site and vicinity. Also, Section 3 of this technical memorandum does conservatively evaluate vapor migration pathways to estimate the outdoor concentrations of BTEX contributed by a groundwater source a the site. Estimated outdoor concentrations that resulted from this evaluation are significantly lower than the U.S. EPA Region IX PRGs for ambient air.

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Comment 7. The above referenced study also included statements that there are other off-site sources contributing to the soil and groundwater contamination. As of this date it has not been demonstrated clearly what part of the existing contamination is the Navy's and what part is from other sources.	**Response 7.** The contribution of potential off-site sources is accounted for by assuming that a plume identical to that identified at the NEX Gas Station exits 200 feet west of the centerline of the NEX plume. It is not the purpose of Technical Memorandum No. 3 to evaluate sources or assign responsibility but rather to analyze contamination migration based on a conservative representation of the conditions at the site and vicinity.